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INSTRUCTION BOOK
1020-C MEGOHMETER

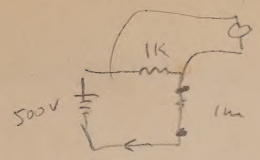
FREED TRANSFORMER CO., INC.
INSTRUMENT DIVISION

INSTRUCTION MANUAL

INDUSTRIAL TEST EQUIP. CO,
21 YONNICOCK AVE.
PORT WASH. N.Y. 11050

FREED TRANSFORMER CO., INC.
1718 WEIRFIELD ST., BROOKLYN (RIDGEWOOD) 27, N. Y.

516-883-1700



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OPERATION INSTRUCTION FOR FREED TYPE 1020-C MEGOHMMETER

Description:

The instrument is a direct reading balanced electronic ohmmeter with an integrated 500, 100 and 50 volt regulated d.c. test potential. Insulation resistance is measured in six overlapping ranges indicated on an expanded scale meter. Low test currents and provisions for discharging capacitive components provide safe operation.

Specifications:

Resistance Range:
1 to 2,000,000 Megohms at 500 volt test potential, 0.1 to 200,000 megohms at 50 or 100 volt test potential.

Accuracy:
Plus or minus 3% at full scale for X1 to X10K megohm range, plus or minus 5% for 100K megohm position.

Test potential:
500, 100 and 50 volts d.c., regulated to plus or minus 5% of their nominal value.

Terminals:
Four terminals are provided, two for connecting the unknown, one ground and one guard.

Controls:

1. Resistance multiplier selector with additional positions for charging and discharging capacitive components.
2. Infinity adjustment control.
3. Calibration check button.
4. Test potential selector switch.
5. Lever switch, applies test voltage to test terminals.
6. A.C. line on-off switch.

Power Supply:
105-125 volts a.c., 50-60 cycles, 17 watts.

Dimensions:
9 1/2 X 10 1/2 X 8 inches.

Net Weight:
15 lbs.

OPERATION PROCEDURE

Connect instrument to a 105-125 volt a.c. power line, if a grounding type receptacle is not available use adapter supplied and connect the green lead on adapter to ground screw on power receptacle. Turn power switch on, allow a five minute stabilizing period before adjusting (infinity) control for infinity reading on indicating meter. Note: This adjustment can be made independent of the position of the "Multiplier" or Test Voltage switches.

The position engraved "CHK" on the "Multiplier" dial has been provided to monitor the 500 volt test potential and should be referred to before and during any extensive testing. With the "Multiplier" switch set at "CHK", test voltage to 500 and lever switch up, press "500 volt check" button. Indicating meter pointer should fall on the red line at mid-scale. Failure of meter to indicate correctly is covered under "Servicing".

Operating controls on this instrument were selected to provide safe and convenient testing, the lever switch engraved "Test Voltage" can be locked in the "Up" position for capacitor measurements or for rapid checking with test leads of components too large to connect directly at the "X" terminals. In the "Down" position a spring return will remove the test potential from the "X" terminals when the lever is released. This feature should be used when connecting resistive components directly to the test terminals. The red indicator light under the lever switch operates when either 100 or 500 volts is applied to the "X" terminals. Note: There is an unmarked position between each test voltage range to protect the measuring circuit from any capacitive component connected to Rx terminals when voltage range is switched.

To measure the insulating resistance of an ungrounded two terminal component, select the desired test voltage. Adjust the infinity control if necessary and connect the test leads or the unknown directly to the "Rx" terminals. The "Guard" and "GND" terminals should be linked as shown in figure 1. Set the "Multiplier" switch to the approximate reisitance value, if known, otherwise start at the X1 position, press lever switch and adjust multiplier for a reading on the indicating meter. The unknown value is the meter reading multiplied by the setting of the range selector switch. It should be noted that the megohmmeter measures whatever resistance is connected between the "X" terminals. This may include series or parallel leakage paths through the insulation or over its surface.

To avoid the possibility of shock when testing grounded components the instrument terminals should be arranged as shown in figure 2. Strapping the "GND" terminal to the "Minus" terminal will place the case of the instrument at the same potential as

When the instrument is operated in areas with high RF fields it may be necessary to use shielded test leads, to eliminate any leakage in the leads, connect the cable shields to the "Guard" terminal, strap "GND" to (minus) Rx terminal as in fig. 2.

In making capacitor leakage measurements the following procedure should be used; select the desired test voltage, "Multiplier" switch to "Discharge", lever switch in the up position, connect capacitor to test terminals and rotate the multiplier switch for a meter indication. Always return the multiplier to discharge position before removing the component from the test terminals. The "Charge" position on the multiplier permits rapid charging of the capacitor, a slight delay when going through this position will bring the capacitor to a full charge.

GUARD TERMINAL MEASUREMENTS

As stated under two terminal measurements, "insulating materials have two leakage paths, one through the insulating material and the other over its surface." The "Guard" terminal has been provided to permit three terminal network measurements by which the resistance of one of the two paths can be seperated.

In conducting three terminal network test which involves one measurement refer to Fig. 3. the indicated resistance across the "Rx" terminals, R1-2 of the network will be correct providing R-2-3 and R1-3 are not too low in value. Since R2-3 is directly across the test voltage source it should be one megohm or higher, R1-3 is across the multiplier resistors and should have a minimum value of 100K ohms times the "Multiplier" indicated value of the range being used.

Fig. 4 is a practical application in the use of the "Guard" terminal for measuring leakage between one wire and the shield of a multi-conductor cable without the readings being affected by leakage to the other wires. Interchanging the "Guard" and "GND" connections will permit measurement between one wire and all others without being affected by leakage to the shield. Other applications in the use of the "Guard" terminal is the measurement of leakage resistance in transformer windings (Fig. 5) and dielectric material using a guard ring electrode as outlined in ASTM publications.

SERVICING

The 1020-C Megohmmeter consists of a balanced electronic voltmeter with its associated regulated supply, an electronically regulated 500 volt test source and zener diode regulated 50 and 100 volt test source.

Under normal operating conditions this instrument should require a minimum of servicing consisting of minor adjustments to compensate for tube aging and or replacment.

"500 Volt and "CHK" Adjust:

Failure of the meter pointer to indicate within the width of the red "CHK" line is due to faulty "Infinity" setting, tube aging or the 500 volt test source requires adjusting. If correcting the infinity setting does not produce the desired results it will be necessary to remove the instrument from the case. Connect a d.c. voltmeter of known accuracy having an input resistance of 20,000 ohm/volts or higher between the minus test terminal and the "GND-Guard" terminal (Fig. 1). Set "test voltage" switch to 500, "Multiplier" switch to "CHK" and press lever switch, if external meter does not indicate 500 volts correct by adjusting control "500 Volt Adj." (R-34 located on left rear of chassis. With all controls remaining as above, press "CHK" button, if meter does not read on "CHK", adjust "500 volt F.S. (R-9) located on sub-panel Fig. 6. Take alternate readings between infinity and "CHK" adjusting both controls if necessary for correct readings.

50 and 100 Volt Adjust:

The 50 and 100 volt test source is fixed to within plus or minus five percent of their nominal values by zener diodes Z1 and Z2 and are not adjustable. Full scale sensitivity on 50 and 100 volts is effected by connecting a resistor of 10 or 100 megohms plus or minus one percent across the unknown terminals. With the "Multiplier" switch set to the full scale value of the resistor, test voltage selector switch to 100, press lever switch and adjust if necessary control (R12) "100 volt F.S." for a reading of "1" on the meter. Follow same procedure for the 50 volt range adjusting if required control (R13) 50 volt F.S.

"Infinity Centering Control"

Control R16 (Fig. 5) will seldom need adjusting, its function is to keep the front panel infinity control within a usable range. If tube (V1A-V1B) is replaced or compensation for tube aging is required, set front panel infinity control to approximatly center

and adjust R16 for infinity on the indicating meter. Due to a wide variation in the plate current balance of some 12AU7 tubes it may be necessary to try several tubes to achieve satisfactory operation.
Note: If the 12AU7 tube is replaced allow a 10-15 minute warm up before adjusting any of the controls.

CALIBRATION

The accuracy of this instrument depends primarily on the applied test voltage and the "Multiplier" range resistors R2-R7. As stated in the above servicing proceedure, the voltmeter used to check the test voltage should have a high input resistance and an accuracy of one percent or better. The "Multiplier" steps can be checked with resistors compatible to the various ranges. Resistors of 2, 20 and 200, 2K, 20K, 200K Megohms at one percent tolerance up to 2K megs and two percent above will give a center scale value on the meter.

Resistors of these high values are voltage sensitive and should be calibrated at 500, 100 and 50 volts, if not feasible their voltage coeficient should be known.

1020-C MEGOHMMETER SHORT CIRCUIT CURRENT

Maximum steady state d.c. current through a shorted test sample.

Range	500V	100V	50V
Charge	< 10 MA.	< 3.6 MA.	< 3.6 MA
X1	" " "	" 3.6 "	" 3.6 "
X10	" " "	" 3.6 "	" 3.6 "
X100	" 5 "	" 1 "	" 500 µA
X1K	" 500 µA	" 100 µA	" 50 "
X10K	" 50 "	" 10 "	" 5 "
X100K	" 5 "	" 1 "	" .5 "

Maximum short circuit steady state d.c. current from minus test voltage terminal to megohmmeter chassis (cabinet)

Test Voltage	500	100	50
Less than	10 MA.	3.6 MA.	3.3 MA

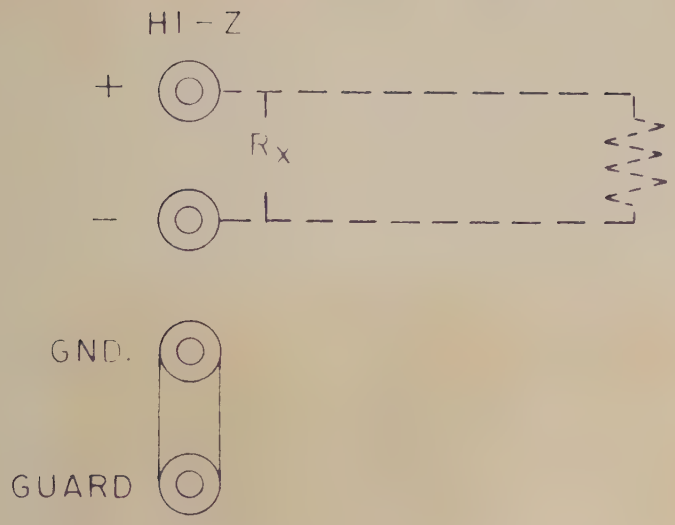


FIGURE 1

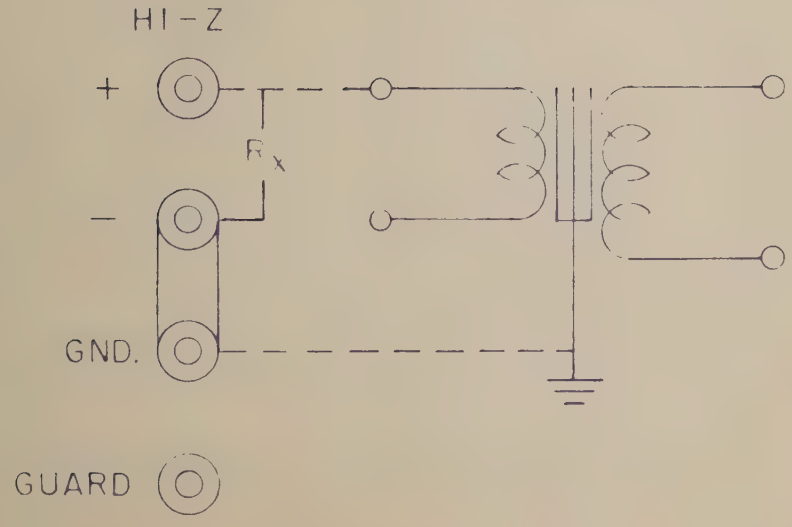


FIGURE 2

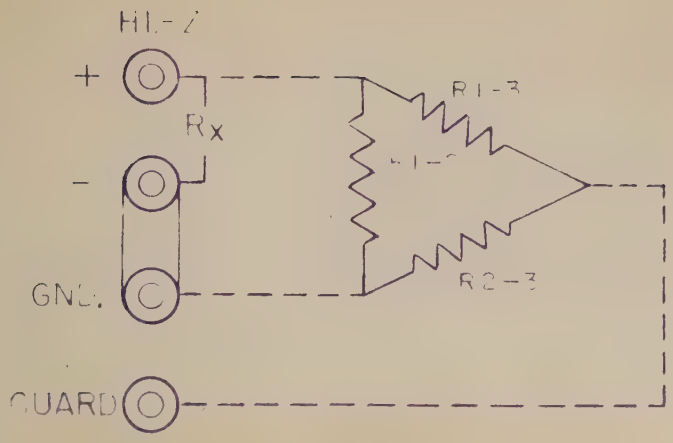


FIGURE 3

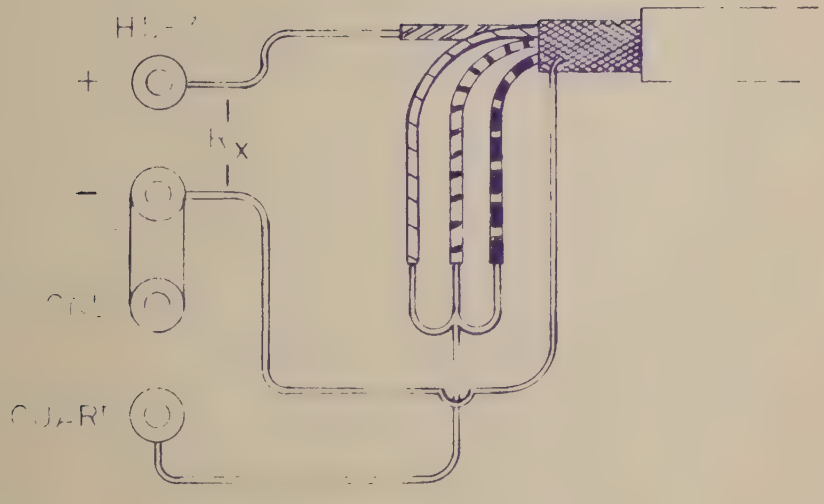


FIGURE 4

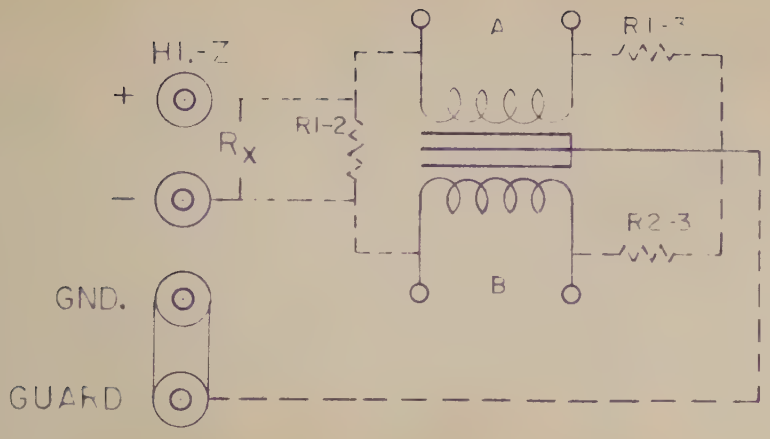


FIGURE 5

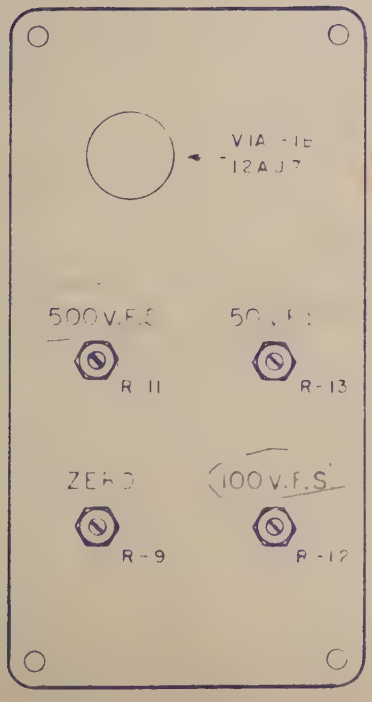
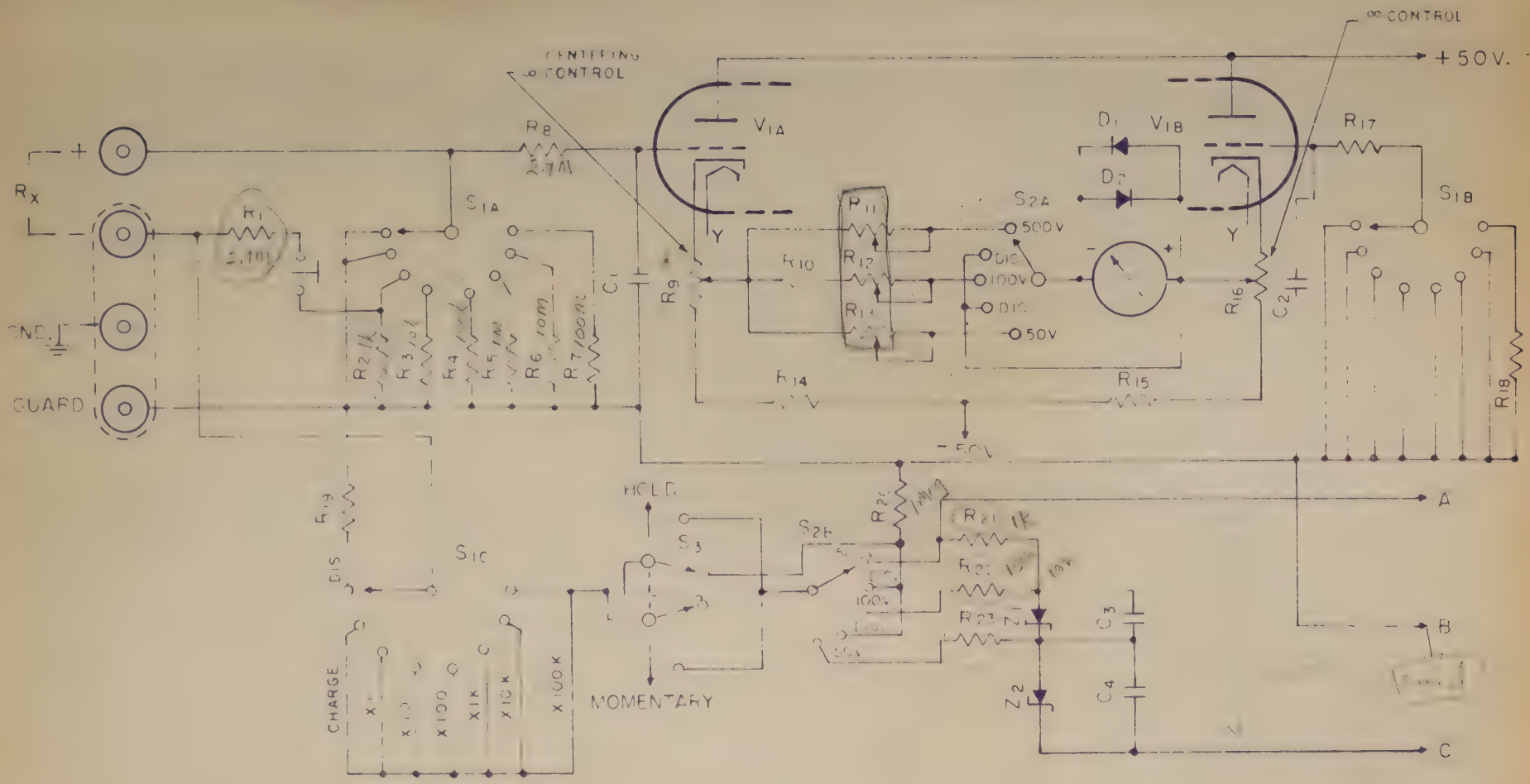
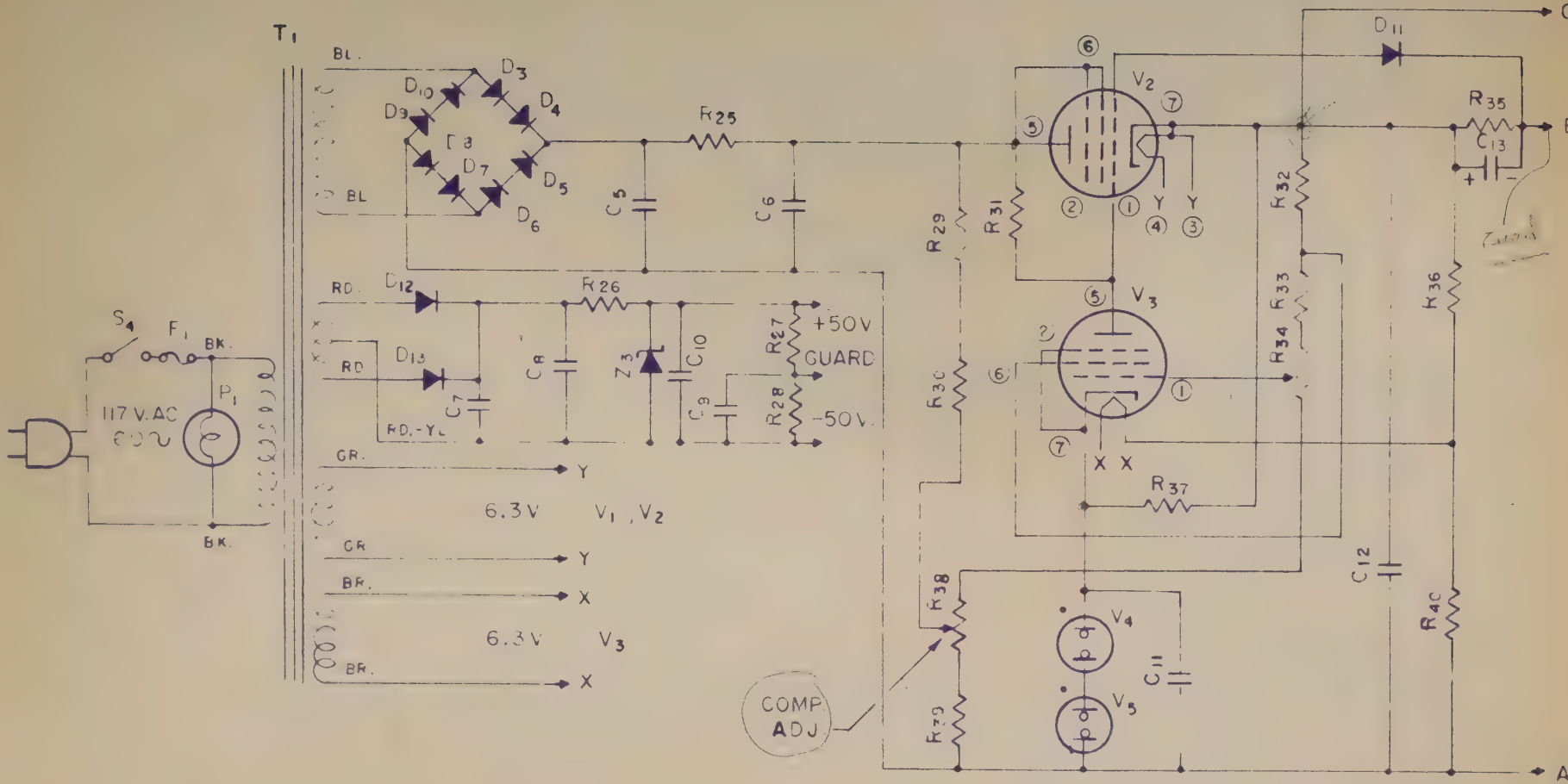


FIGURE 6



MEGOHMMETER
MEASURING CIRCUIT
TYPE: 1020-C

7-23-62



MEGOHMMETER
POWER SUPPLY
TYPE: 1020-C

7-23-62

PARTS LIST

RESISTORS

R-1	2.7 Meg		1/2W	+/-10%
R-2	1K		1W	1%
R-3	10K		1W	1%
R-4	100K		1W	1%
R-5	1 Meg		1W	1%
R-6	10 Meg		1W	1%
R-7	100 Meg		1W	1%
R-8	2.7 Meg		1/2W	+/-10%
R-9	500 OHMS			Potentiometer
R-10	3.3K		1/2W	+/-10%
R-11	3K			Potentiometer
R-12	5K			Potentiometer
R-13	3K			Potentiometer
R-14	62K		1/2W	+/-10%
R-15	62K		1/2W	+/-10%
R-16	500 Ohms			Potentiometer
R-17	2.7 Meg		1/2W	+/-10%
R-18	100 Meg		1W	+/-5%
R-19	47K		2W	+/-10%
R-20	1 Meg			+/-10%
R-21	10K		2W	+/-10%
R-22	150K		2W	+/-10%
R-23	1K		1/2W	+/-10%
R-24	2.2 Meg		1/2W	+/-10%
R-25	17.5K	WW	5W	+/-5%
R-26	10K	WW	5W	+/-5%
R-27	47K		1/2W	+/-10%
R-28	47K		1/2W	+/-10%
R-29	2.2 Meg		1/2W	+/-10%
R-30	1 Meg		1/2W	+/-10%
R-31	1 Meg		2W	+/-10%
R-32	220K		2W	+/-10%
R-33	220K		2W	+/-10%
R-34	100K			Potentiometer
R-35	2.2K		1/2W	+/-10%
R-36	4.7 Meg		1/2W	+/-10%
R-37	220K		2W	+/-10%
R-38	100K			Potentiometer
R-39	47K		2W	+/-10%
R-40	2.2 Meg		1/2W	+/-10%

CAPACITORS

C-1	910 PF Mica	500 VWDC	+/-5%
C-2	910 PF Mica	500 VWDC	+/-5%
C-3	.25 MF Mylar	200 VWDC	+/-10%

continued on following page

METER 360-TPS83

CAPACITORS continued

C-4	.25 MF Mylar	200 VWDC	+/-10%
C-5	2 MF Paper	1000 VWDC	+/-10%
C-6	2 MF Paper	1000 VWDC	+/-10%
C-7	.01 MF Mylar	400 VWDC	+/-10%
C-8-C-9	10-10 MF Elect.	450 VWDC	
C-10	.1 MF Mylar	200 VWDC	+/-10%
C-11	390 PF Mica	500 VWDC	+/-5%
C-12	.01 MF Mylar	600 VWDC	+/-10%
C-13	15 MF Elect.	25 VWDC	

T-1	Transformer	35324
F-1	Fuse	1 Amp.
V1a-V1b	12AU7	Tube
V-2-V-3	6AU6	Tubes
V-4-V-5	ZZ-1000	Reference Tube

D-1-D-2-D-11	Silicon Diodes	G.P.Signal Diode
D-3-D-10	Silicon Rectifiers	800 PIV. @ 500 MA.
D-12-D-13	Silicon Rectifiers	800 PIV. @ 500 MA.

Z-1-Z-2	Zener Diodes	50 Volts +/-5% 3/4Watt
Z-3	Zener Diode	100 Volts +/-10% 1.5Watt

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